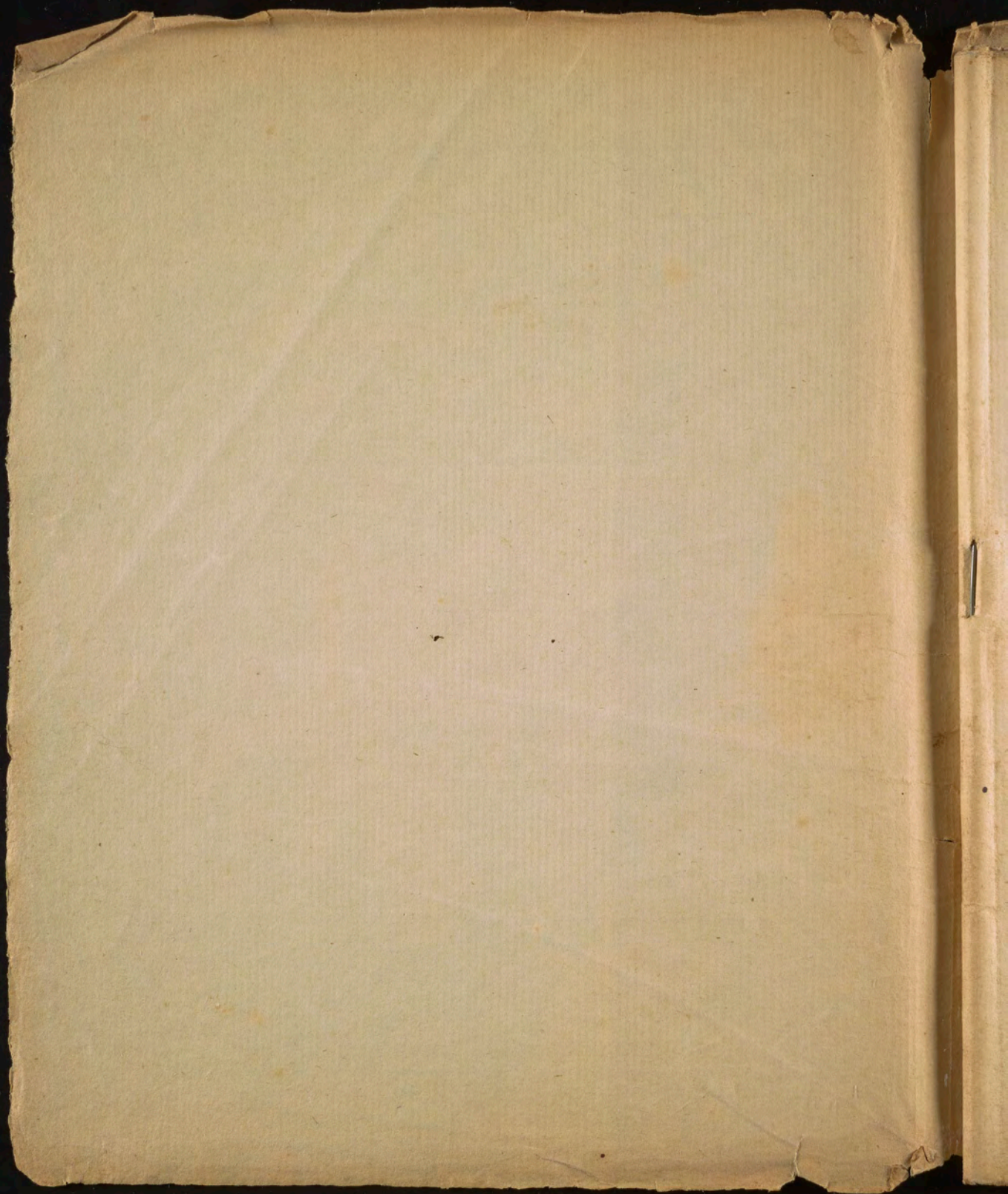


Yi 2

7397

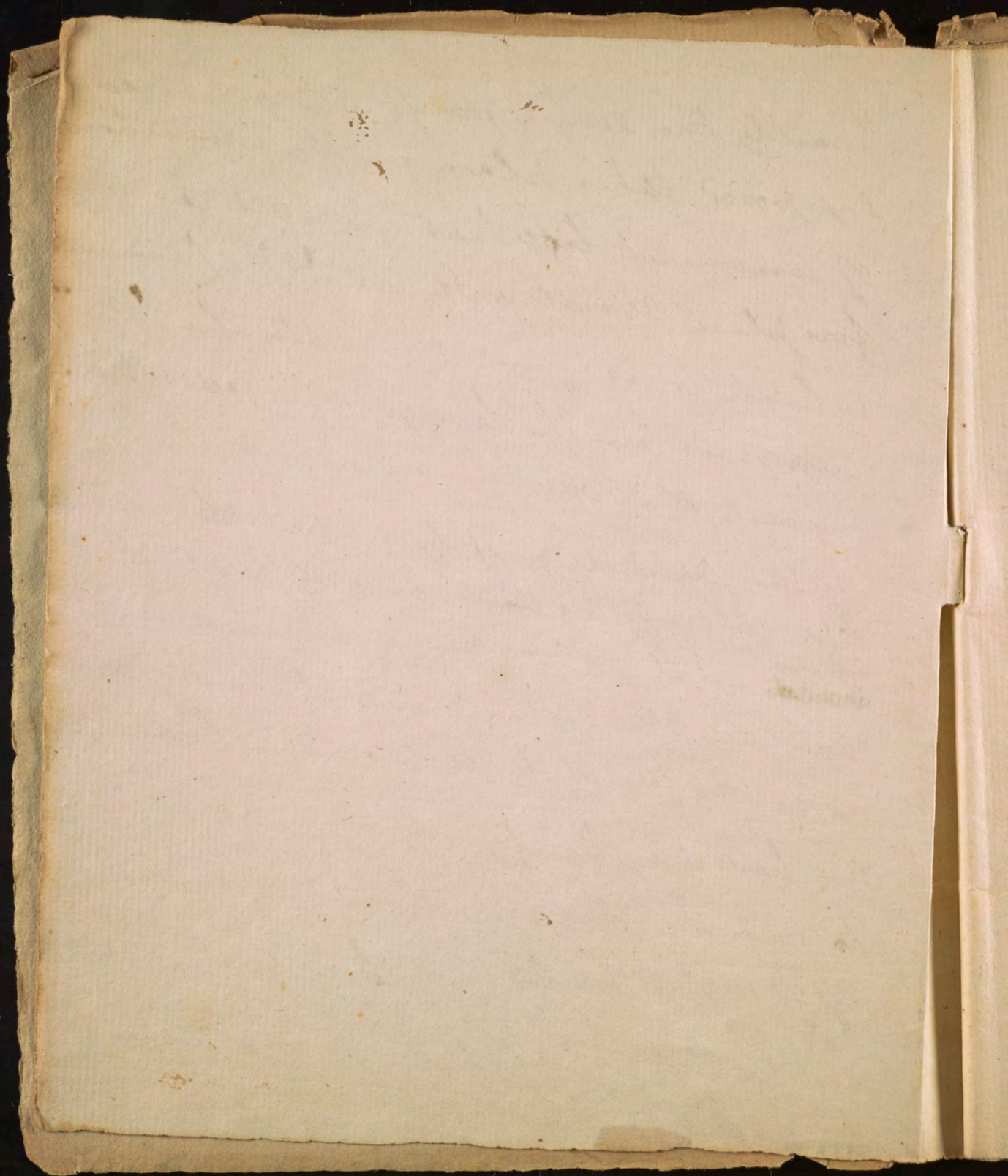
F 20

Lecture on
animal heat.



Exactly the same process Dr Black has supposed takes place in the production of animal life heat. We all carry a fire place about with us, & the Chimney which contains it is rated the Dr. supposes in the lungs. The facts which support this opinion are as follow.

1 The Absolute necessity of Air to ~~the~~ animal life. There is no animal in the world that ~~exists~~ ^{lives} without it, whether it exist in the air - in the water, under the earth, or upon the face of the earth. Birds breathe, and yet they should suffer from an inability to perform that function in their rapid flight thro' the ~~at~~ air, they are provided with Cells which serve as reservoirs of



Air, and which probably afford them
 the oxygen which supports their heat.
 Even the bones of birds contain air
 and probably for the purpose that has
 been mentioned.

Fishes respire Air with water by
 means of their gills. They sicken
 & die when deprived of it. Their Air
 bladder may probably supply for a
 while the want of external Air, al-
 though the principal design of it is
 to assist them in ascending & descending
 in the water.

Insects which are destitute of lungs



9

and gills do not live without Air.
- It is conveyed to them by means of
long tubes called tracheae or stigmata
extending from different parts of the
body. In some insects these tubes arise
from the posterior - in others from
the back and sides. If these tubes be
stopped by means of Oil, the insect
dies from suffocation - that is from
the want of Air.

Worms likewise exist only in con-
-sequence of this communication with
the Air.

Snails die without Air. ^{When} ~~before~~
they retreat from the cold of winter,

~~whose~~

V which Dilatations & Contractions
may be distinctly seen, and to this
tube, the Air has access. Curvier
speaking of this mode of ~~respiration~~ curious
Continuance says "the blood not being
able to go in search of Air, the Air
goes in search of the blood". —

The heat in all these classes of
animals is different. In fish it is but
2°. above the temperature of the water
in which they swim. The heat
generated is generally in proportion

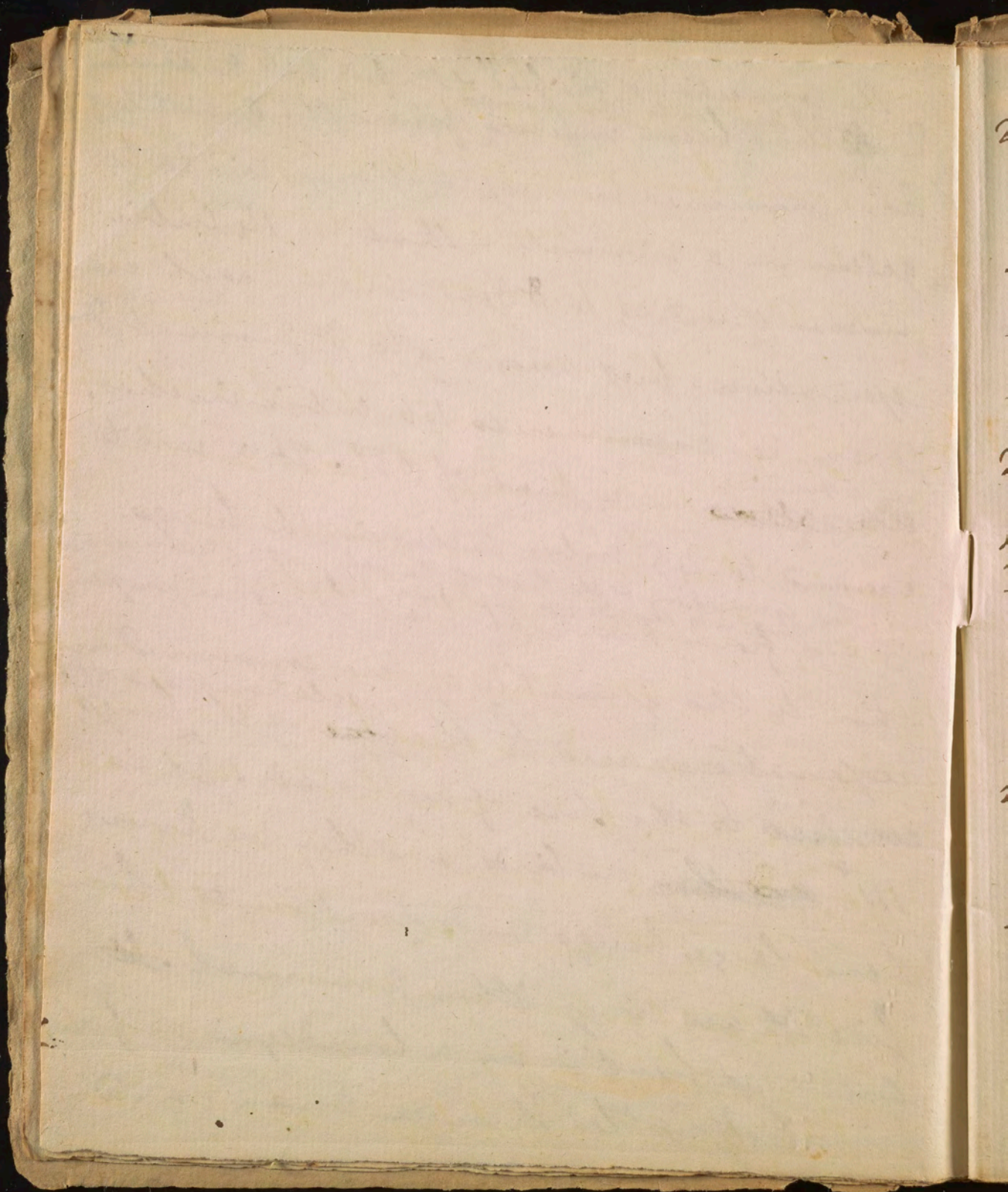
they cover their bodies with a thin coat
 so thin as to admit the passage of air
 through it. If this coat by any accident
 become too thick to admit the air,
 they perforate it in order to make a
 passage for it.

~~Also~~ The Toad which has been found
 in the ~~trunk~~ middle of the trunks of large
 trees, and in the Centre of Stones where
 it has existed for one or two Centuries
 it is ~~generally~~ generally supposed, receives air
 in order to preserve its heat thro' the pores
 of the trees, and the crevices of the stone.
 Lastly - ~~there~~ even those Insects which
 are destitute of lungs have a membranous
 tube running along their backs in

to the size of their lungs, and the
quantity of air consumed in them.

The connection of the heat of the body with the admission
2 ~~of~~ ^{the} air into the lungs has been inferred from the quantity of
air consumed in respiration, said to be
a gallon in a minute - that is 14 cubic
inches according to Dr Goodwin in each in-
-spiration, but according to Dr Jussieu, & Dr
Menzies experiments 40 cubic inches,
in a minute
~~that is~~ in a heat of 80°. It is said to

expand to 43 cubic inches in the lungs.
The connection of the heat of the body with the admission
3 ^{of air into the lungs has been admitted} from animal heat being in propor-
-tion to the quantity of air consumed in
respiration, and to the ^{relation, & size of the} size of the lungs;
~~exactly~~ to the size of animals. It is
III: ~~exactly~~ in birds, and they we know
have larger lungs in proportion to their
size than any other animal. ~~It~~
Animal heat is in a low degree in fish,
insects, & reptiles than in man, and



many other breathing animals, and they
 we know have very small lungs in pro-
 -portion to their size, and consume but
 little Air in respiration. It is in a very
 low degree in the toad for which reason
 Mrs Swift informs us in his travels into
 Spain, that the Spanish ladies sometimes
 toads in their bosoms in order to lessen the
 heat of their bodies in hot weather.

4 - From the Change which is induced in
 the Air which is discharged from the lungs
 in exhalation being exactly the same as
 that which is produced in the Air after it
 is robbed of its Caloric or matter of heat
 by the Combustion of a piece of wood, or
 any other ~~body~~ body. The Air we expire
 is true Arto- or phlogisticated Air, ^{it}

not only extinguishes flame, but is fatal to animals that breathe it.

5 From ~~exp~~^{exp} the Arterial Air which is discharged from the lungs being ^{exp} warmer according to Crawford than pure Air which is taken into the lungs.

6 From the Arterial blood on which the oxygen ~~air~~ Air first acts, being warmer by one degree & $1/2$ according to Crawford than Venous blood. It is as $11 \frac{1}{2}$ to 10 .

According to Mr Hunter's ^{right} Anatomical Thermometer it was 99 in the ^{to} ~~left~~ Ventricle and 94 in the left Ventricle of a Dog, hung for the purpose of ~~not~~ ascertaining this fact by Mr. Lerman.

7 From ~~the red color of the blood.~~
~~the red color of the blood.~~
~~in the body after the oxygen of the~~
This

which

Color we know is derived from Oxygen
 in the Colicthar of Vitriol, in red lead, &
 in horns preserved with salt petre, ^{ch} w:
 salt abounds with Oxygen. now the
 red Color of the blood is supposed to
 be derived in like manner from the
 Action of the Air upon it in the lungs.
 It is certainly much redder & in the
 pulmonary Vein than in the pulmon-
 -ary Artery after the Air has acted upon
 it, and much redder in an Adult
 than in a ~~child~~ ^{fetus} which has never breath-
 -ed.

& From the analogous effects of Oxygen
 Air upon a burning body, and upon the
 lungs. The more of this Air that can

the presence of ... that
... is the ...

15

be applied to a burning body, the more
vivid is the flame emitted by it, and
the greater is its heat. In like manner,
the more of this Air that is received into
the lungs, the greater the generation of
heat - and hence - the increased heat of
the body in a fever & after exercise.

9 In ~~the~~ ^{the} ~~former~~ ^{former} of the Cause of Animal
Heat which has been delivered, an attempt
has been made to explain ^{that} of passage in the
book of Job in which he describes the Art
of Respiration in the Leviathan" By his
nostrils a light doth shine, and his eyes
are like the eye lids of the morning. Out
of his mouth go burning lamps, &
sparks of fire leap out. Out of his

✓

[Faint, illegible handwriting, likely bleed-through from the reverse side of the page.]

Nostrils goeth smoke, as out of a
 Leathing pot, or Chaldron. His breath
 kindleth Coals, and a flame goeth out
 of his mouth". ~~From this history of~~
 The water ^{that} discharged from the nostrils
 of the Leviathan it is ~~that~~ in
 a state of inflammation, it has been
 said is produced by the decomposition of
 any ~~generates~~ such as goes forward in a
 culinary fire. -

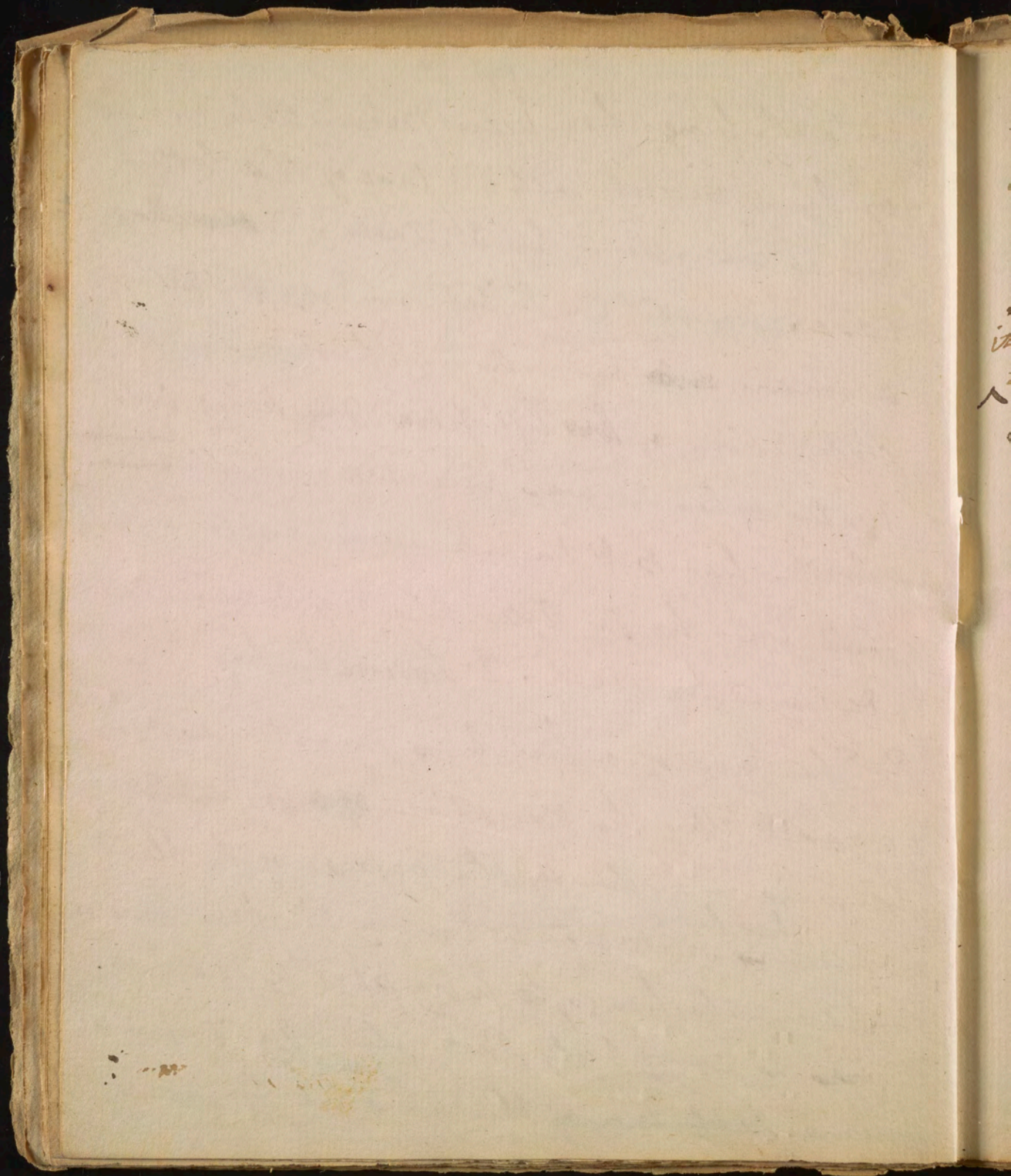
Simple and beautiful as this theory ~~is~~
 appears to be, there are several solid objections
 to its being the sole, or exclusive cause of
 Animal heat. I shall briefly mention these
 Objections.

1 The heat of the body has been observed to
 be the same, when the admission of Air

v "medicin legali" mentions a case in
which the heat of the body continued
four days after death had taken place.

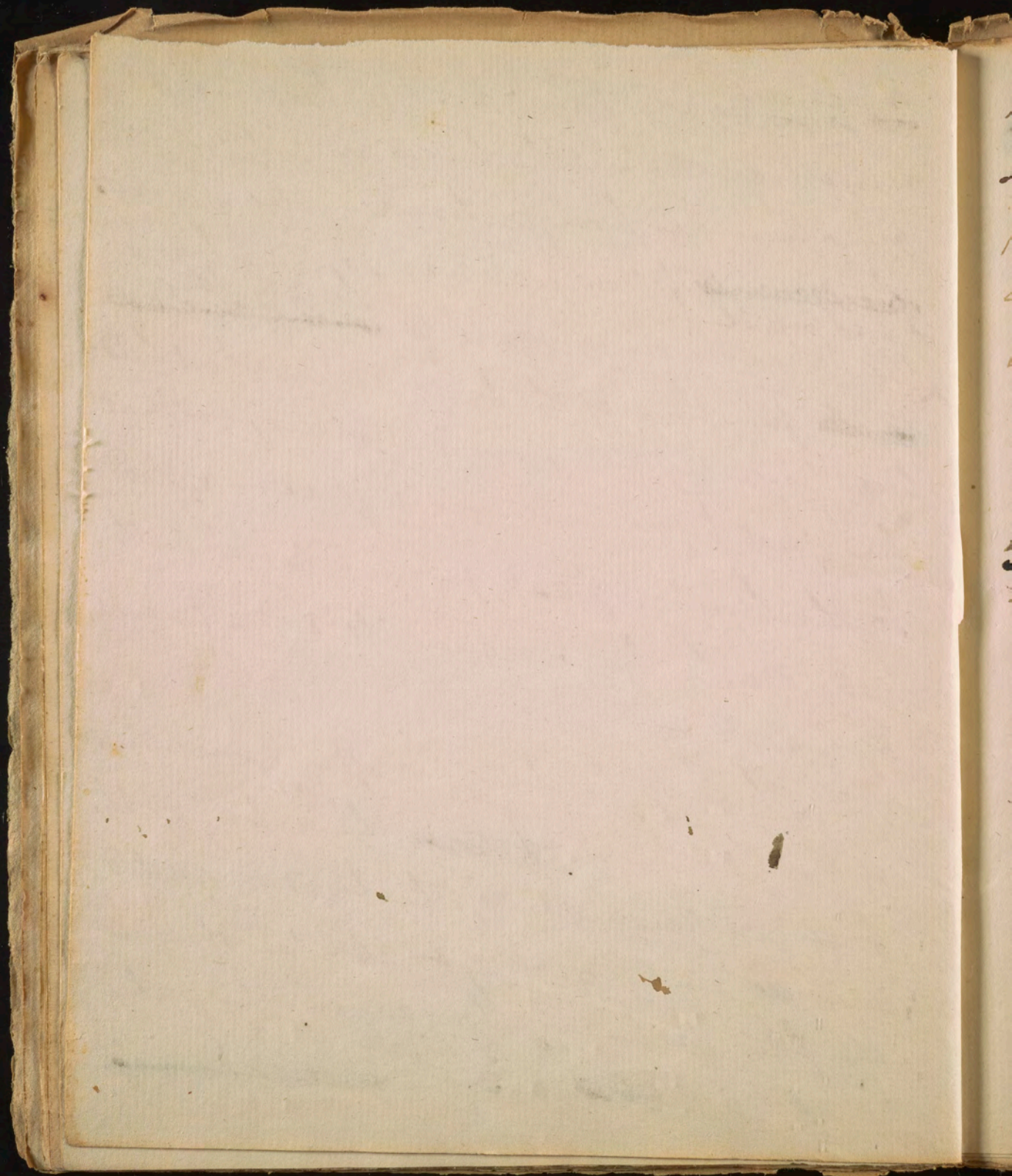
into the lungs has been prevented by disease
 or by apparent death. A case of the latter
 kind is mentioned by Dr Haen. A ~~similar~~
 case occurred in Philad^a on July 5. 1811 in
 a man ~~who~~ in whom there was a total
 extinction of ~~his~~ life from drinking cold
 water when he was very warm. His ^{whole} ~~body~~
 head - hands & trunk were uncommonly
 hot four hours after his respiration was
 destroyed by death. Dr Lodovici in his V

2 The heat of a limb is sometimes en-
 -creased after the operation ~~of~~ for ~~the~~
 Amputation, whereby the passage of the blood
^{has been} which is supposed to convey the heat genera-
 -ted in the lungs, to every part of the body,
~~but~~ is completely obstructed. I witnessed a
 remarkable case of this kind in ^{from 1811 in} Dr. Morey,



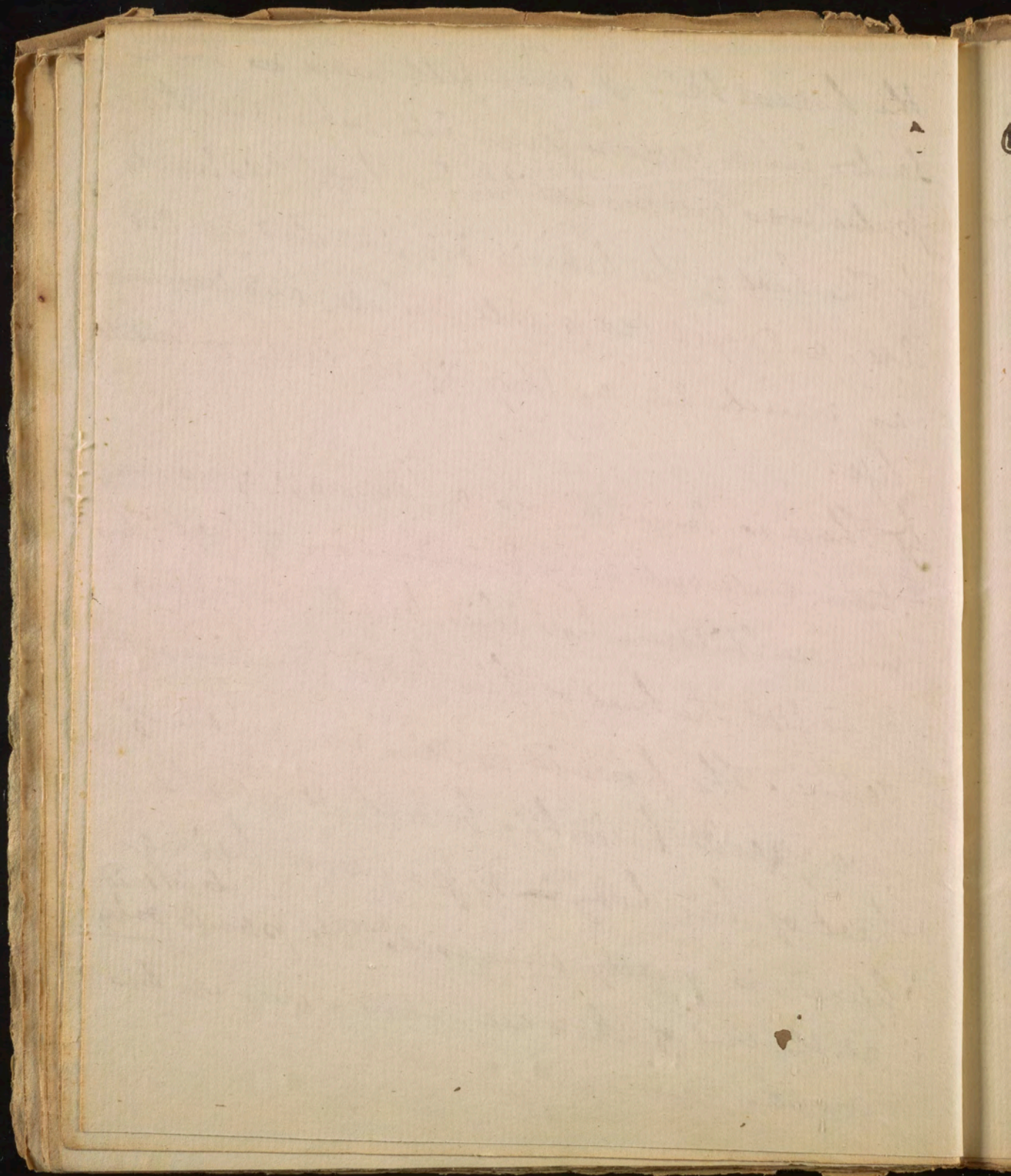
a patient of Dr. Rhynk. The heat was
~~much greater~~ much greater in the limb on which the
 operation had been performed, than in the
~~the opposite~~ fellow; It was so, long before
 it was possible for the Anastomosing vessels to ^{supply the} ~~convey blood~~
~~the~~ function of the large artery that had
 been recently tied up and divided, and that
 had just before conveyed a stream of blood
 to the limb. I ask from whence in this
 case did the limb receive its extra quantity
 of heat? —

3 The heat of the body is often independent
 of the frequency of ~~from~~ the pulse, or the
 force, or quantity of the blood propelled
 into ~~the~~ every part of ~~the~~ it. We observe
 the skin to be very hot when the pulse
 is at 40, ~~and~~ ^{I think} and the ~~temperature~~ ^{is}



the hottest skin I ever felt was ~~to~~ in a
 sailor in a yellow fever in whom the
 pulse was imperceptible in both his wrists.
 & The heat of the body is diminished in old
 age, and yet old people inhale, and consume
 as much air as they did in early, or middle
 life.

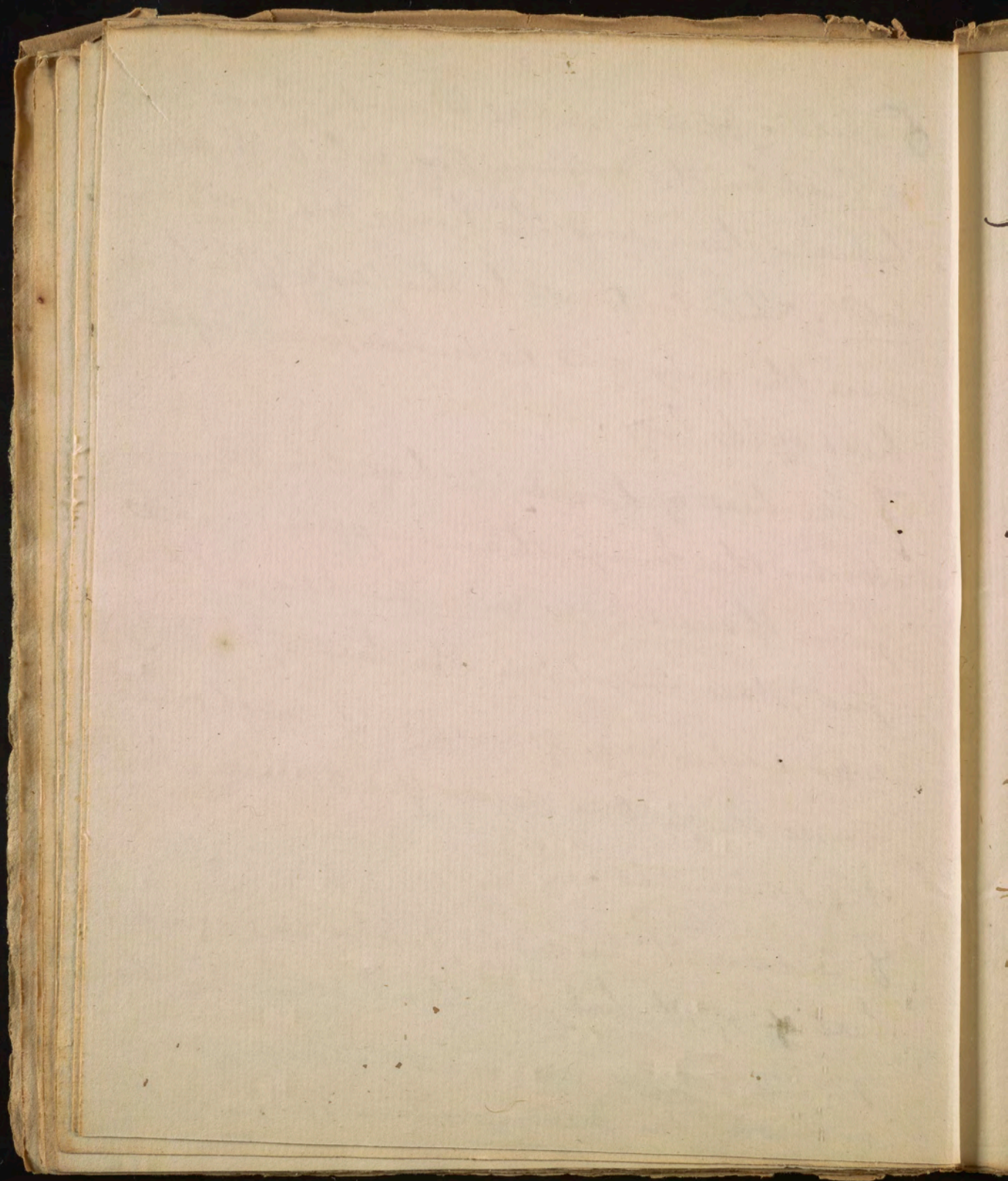
There is sometimes a stoppage of respira-
 -tion without any diminution of heat. Thus
 we see Children hold their breath in crying,
 and yet the heat of their bodies continues the
 same. The horse it is said in a race of
 two yards holds his breath, & yet the
 heat of his body ~~is~~ so far from being
 lessened, is greatly increased. ^{it is said} He pants only
 at the end of the race, - and never in his
 course. —



6 There is often a partial & morbid sensation of heat in the extremities while the parts between them, and the lungs are cool or cold. This could not be the case if the lungs were the only and exclusive source of the heat of the body.

7 The heat of the body is but one degree greater in the lungs, than in parts remote from them. Now were the lungs the fire place in which the heat of the body was exclusively generated, it ought to be more than one degree greater than in the extremities.

8 Certain Aliments and Drinks increase the heat of the body, without acting in the smallest degree upon respiration, or increasing the decomposition of Air in the



lungs.

9 Certain Sounds increase the heat of the body. This has often ^{been} experienced after the firing of Cannon. Now in this case, no additional decomposition of Air takes place in the lungs for there is no increase of re-
-piration.

10 Light increases the heat of the body. This is often experienced on a hot evening in Summer when a candle ^{is} suddenly brought into a dark room. No one can suppose ~~that~~ in this case more Air to be taken into the lungs, or a ~~new~~ sudden decomposition of ~~air~~ an increased quantity of Air to have taken place in them.

^{and lastly}
11 Certain passions increase the heat of the body without the least influence upon respiration, or the decomposition of Air in

the lungs.

I have attempted year after year to explain these facts so as to reconcile them to the theory of my illustrious Master Dr. Black, but I have never been fully satisfied with my solutions of them. I am convinced therefore to reject the ~~Decomposition~~ of air in the lungs as the exclusive cause of animal heat, and to call in an additional cause for that purpose, which I shall now submit to your examination. I shall begin by delivering a few general propositions.

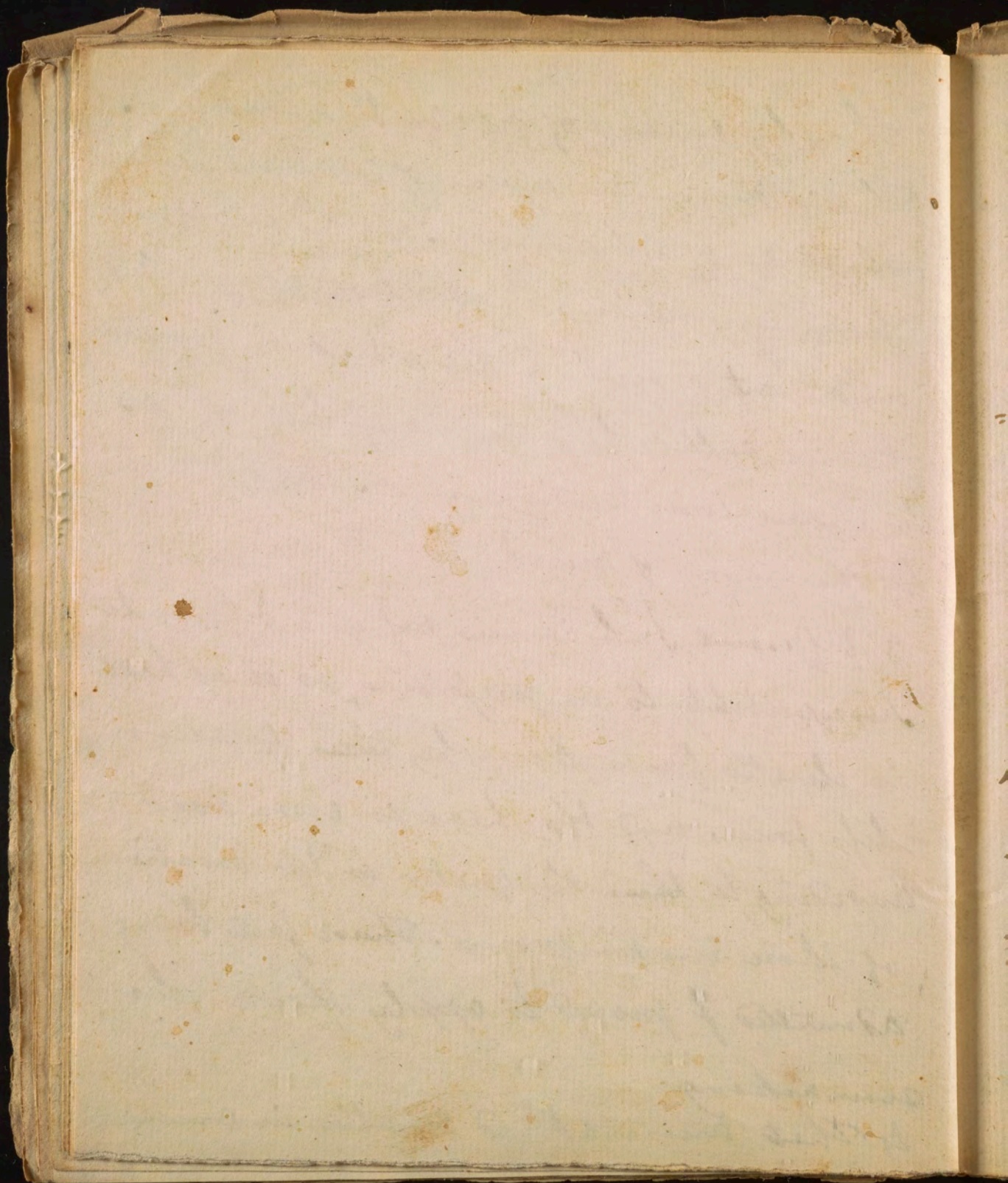
- 1 All bodies contain a certain portion of caloric, or the matter of heat in them.
- 2 These bodies are so constituted as to emit heat from imperious made upon

occurs likewise
V It ~~takes place~~ in wood, the protracted
friction upon which, not only elicits
heat, but induces flame. It is thus
the Indians in this Country kindle
their fires. —

them by means of friction & percussion.
 This is obvious in a piece of Cold iron under
 the stroke of a hammer. It takes place
 from impressions made even upon this,
 and that to such a degree in an instru-
 -ment called the "pneumatic briguet" as
 to induce Combustion in a Substance known
 by the name of punk.

3 Different Substances possess a different
 susceptibility to impressions, so that heat
 is elicited from them by ~~the~~^a greater or
 less force, and the heat is increased
 according to ~~this~~ the greater or less duration
 of those impressions. These facts being
 admitted I proceed to apply them by
 remarking

4 That Animalized Matter in Common



24

^{with} with the substances that have been
mentioned, contains a quantity of
Caloric, or matter of heat in it, which
it emits in common with those sub-
stances in consequence of impressions
made upon the body, and thus produces
the sensation and other phenomena
of animal heat. In addition to the
facts that have been mentioned, of
the production of heat from Aliments
sounds, light and ~~into~~ ^{the} action of
impressions upon the body, I shall mention
^{two} ~~the~~ facts from Dr Peart. The hand of a
man in good health was placed in a
basin of water at the temperature of
56° - ~~the~~ while his hand was

quiescent, the heat of the water rose to
 65° - that is 9° . ~~Thence~~ But when
 he moved his hand & fingers in the
 water it rose to 73° - that is 17° . Again,
 he put his hand into a basin of water
 at 57° . In this situation ~~he~~ he filled
~~all its~~ ~~muscles~~ all its
 muscles by an act of his will,
 without moving his hand. The water
 rose in this case ~~above the~~
~~five~~ five degrees beyond its temperature
 at its quiescent state. Then we see heat,
 produced as in the "pneumatic briquet"
 by simple pressure. Who after the result
 of these experiments can suppose animal
 heat to be the ~~pure~~ effect of respiration only,
 or the decomposition of air in the lungs?
 It would seem from all the facts that

V₄ are ~~these~~ certain exercises of the
Mind of a stimulating nature? we find
the heat of the body increased by them par-
-ticularly by ^{Love,} Anger - and terror.

26

have been mentioned, that ^{a portion of} animal heat ^{like} ~~the~~
animal life is the product of stimuli,
acting upon different parts of the body

theory

Let us now inquire how far the ~~theory~~
I have delivered agrees with the phenomena
of animal heat in the healthy & diseased
body; and how it is applicable to the prac-
tice of physic - or the cure of diseases.

1st Is warm Air a stimulus? we find the
heat of the external parts of the body increased
by its action upon them
2 Are aliments & Drinks when taken into
the stomach of a stimulating nature? we cer-
tainly observe the heat of the body to be increased
by them. This is most observable after a
full meal.

3 ^{Do} Wounds, light, and Odors stimulate the
senses -? we observe the heat of the body to
be increased by their action upon them. ✓

